



Interactive comment on “Using model reduction to predict the soil-surface C¹⁸OO flux: an example of representing complex biogeochemical dynamics in a computationally efficient manner” by W. J. Riley

Anonymous Referee #2

Received and published: 21 January 2013

This manuscript presents an application of the High-Dimensional Model Representation (HDMR) in an isotopic model of soil CO₂ fluxes. The approach greatly decreases computational time and is of valuable use for integrating soil isotopic fluxes in more complex Earth system models. The paper is interesting and the application of this methodology should also interest model developers in other branches of Earth system modeling.

However, I feel the manuscript does not provide enough detail to reproduce the results or exemplify the use for other applications. I believe this additional information

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would greatly improve the value of this contribution and would make it more suitable for publication in Geoscientific Model Development.

Specific comments

- One of the main objectives of Geoscientific Model Development is to provide detailed model descriptions that ensure their reproducibility. The journal encourages the submission of source code and user manual, so the model or the technical aspects presented in the manuscript can be evaluated or reproduced. I encourage the author to provide additional details about his contribution, e.g. link to source code and user manual, or pseudo code that can be used as template for reimplementation.
- The ISOLSM model needs to be described in more detail. Model description in this case is important for the reader to understand the level of complexity and nonlinearity of the model, and therefore get an understanding of the advantage of the HDMR. Although the model is already described in Riley et al. (2002), it'd be very useful if you provide a list of the main equations, or the phase-space dimension, number of variables, parameters, etc.
- In section 2.3. you point out that the HDMR methodology was applied to a solution of the ISOLSM model at steady-state. What do you mean by steady-state in this nonlinear model? Have you studied the dynamical behavior of this model? Is it possible that by changes in parameter values the stable 'steady-state' solution drifts to a non-stable or cyclic solution (bifurcations)? Perhaps it would be helpful if in the model description section you mention the expected dynamic behavior of the system and whether the 'steady-state' is a stable node or cyclic behaviors are possible. This information would help the reader to understand whether the

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HDMR methodology may have limitations for special cases of nonlinear dynamics.

- The discretization scenarios are very helpful to evaluate possible numerical error. Would it be possible to make a more general statement about the effect of discretization on the error of the predictions? For example, does the error decrease linearly with depth increments (discretization size)?

Technical comment

- The first three paragraphs presents very basic information not necessarily needed for this manuscript. Perhaps you can reduce the length of the introduction by merging some of the ideas of the first three paragraphs into a single one.
- Page 3473, line 20. above canopy *water* vapor?
- Page 3474, line 1. What is V-SMOW?

Interactive comment on Geosci. Model Dev. Discuss., 5, 3469, 2012.